

Accelerator Systems Division Highlights Ending December 10, 2004

ASD/JLAB: Cold Linac

The H-12 cavity string assembly is complete. The string is leak-tight and has been transferred for start of cryomodule assembly.

Processing of fundamental power couplers was completed by SNS staff this week. The final pair of couplers for string assembly was received at JLab this morning. Assembly of the H-2 string is underway.

The H-9 cryomodule was shipped to ORNL this week. This will be the final shipment before the Christmas break.

ASD/BNL: Ring

ASD's Graeme Murdoch and Mike Holding were at BNL to review Pearson's 36Q85/36CRD30 radiation hardened magnet assemblies. Meeting notes are being prepared.

The following equipment was delivered to SNS/OR this week: One long injection kicker magnet and stand; RF rack and power supplies; RTBT vacuum chambers (8); two HEBT momentum scraper drives and eight HEBT charge exchange scraper drives.

BNL equipment that will ship later today: Injection doublet assembly #1 and its lifting fixture; the repaired #1 injection septum magnet; QMM kicker; tune kicker; damper kicker; a spare 36cm BPM (for the target harp assembly).

Being prepared for our next shipments: RF #4; RF wall current monitor; BLM Ion Chambers (222 total); three crates of BLM / VME chassis (Hoff); injection doublet #2; injection kicker magnet (small #2); RF doublet #1.

Electron detectors: Our measuring apparatus has been repaired and is being set-up to test and qualify the SNS electron detectors.

Transceivers inside the power supply interface (PSI) modules need to be replaced. While ninety of the PSI units are now in service at SNS/OR, ten units have failed due to incorrect components used in the transceiver circuit (vendor error). Bob Lambiase has sent a letter to Apogee Labs (vendor) requesting their help in addressing these ORNL issues. In his letter to Apogee Labs, Bob presented two options for their consideration:

1. Send the units back to Apogee to correct the mistakes.
2. Have someone from Apogee go to Oak Ridge to modify the units.

Extraction Lamberton Septum (Alpha Magnetics) – A third coil has been wound; the first two have been potted. Work on the core is progressing well at Allied Engineering. The circulating beam tube is being flown to BNL next week for TiN coating.

RTBT bend magnet (17D224) – A non-conformance in the magnet steel has been resolved with the supplier, Pioneer Steel. Pioneer is on track to deliver the magnet steel to BNL by January 1st.

Magnetic measurements of the first 36Q85 radiation hardened quadrupole will be finished on Monday. (1.0/1.3 GeV field comparisons at set-point currents are being completed today.) Data are being evaluated; unit #2 is sitting in the wings, ready to go.

The fabrication of the drift pipes downstream of QH01 (Injection Dump) is underway at BNL Shops. The 30Q58 (QH01) chamber is being set up for flange welding.

The two extraction (downstream) doublet chambers have been welded to the BPM and leak checked.

Repair of the leaky bellows of the spare quarter-cell chamber was not successful. The bellows will be cut-out and replaced with a new assembly.

Another extraction kicker module has been TiN coated bringing the completed total to twelve (12/14).

Controls

The final design review for the Personnel Protection System (PPS) was held early in the week. The focus was on access control for the HEBT, Ring and RTBT, but the discussion ranged more broadly and the committee made several suggestions which will of course be seriously considered.

A “mini-workshop” on strategies for implementation of the EPICS Alarm Handler at SNS was also held this week. Requirements have been documented and a plan adopted. First deliverables are promised for the end of January.

Another workshop was held to consider options for better accommodating PLCs and other low-level devices on the ICS network. There are some concerns that communications to these devices may degrade as network traffic increases. One option is to configure our network so that PLCs, etc. communicate over their own VLAN (Virtual Local Area Network). A VLAN was established for testing to better understand the advantages/disadvantages of this option.

Members of the Controls Team also met with representatives of the SNS and ORNL “Information Technology” (IT) groups. Approaches were discussed to use these resources to assist the overworked Controls System and Network Management team.

One member of the Controls team visited LBNL to continue the collaboration on low-level RF controls (LLRF). EPICS support for the most recent field control module (FCM) – the heart of the system – was installed. History buffers were extended. A “setpoint curve” was successfully tested, although automatic configuration of its many parameters is still required.

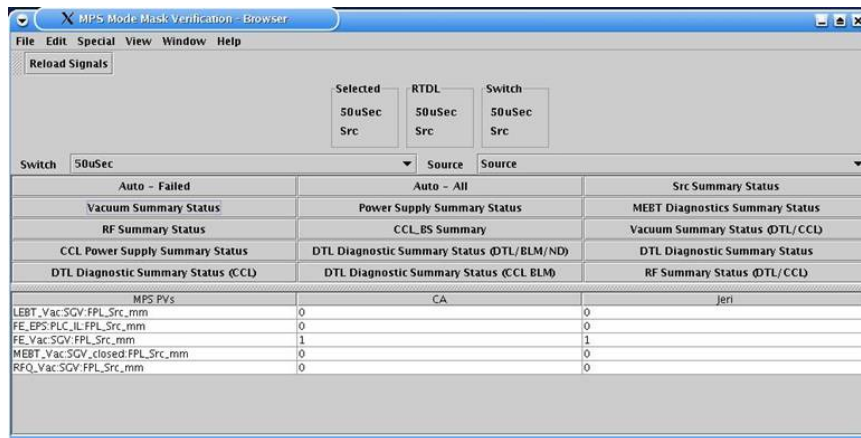
The controls team submitted four abstracts for the upcoming PAC05 Conference, and team members are listed as co-authors on about a dozen others.

New RF devices for cryomodules MB 1-8 were added to the PPS system which was then completely recertified. Electricians are continuing PPS wiring and cabling in the HEBT service building and HEBT entry station. At the same time, the PPS fiber rack in the CLO CER (equipment room) is being filled with fiber-to-coax converters in support of the upcoming (February 05) move to the CLO control room.

An SRO was submitted for installation of additional communications and interlock cables in the HEBT. This work will be started next week. Installation of power circuits in the CLO Central Control Room (CCR) and Central Equipment Room (CER) was finished. Installation of communications circuits will begin next week. A design for the Target Protection System (TPS) mounting and enclosure as well as conduit mounting for the CCR was also completed.

An automated test program is in beta test to verify MPS mode masks. The program reads the mode mask configurations from the Oracle database and compares the masks to defaults and Process Variable (PV) read backs from EPICS; then generates a report listing errors. The java program was written using the framework developed by the Accelerator Physics group. The next phase will report MPS faults in machine and beam modes not in use to aid in switching to different beam power or different beam stops.

The MPS “soft IOC” was upgraded to the current version of EPICS, and the “Linux stats” utility was added. New MPS PLC code was installed during the maintenance period to fix some key switch errors. Meanwhile the controls lab MPS system was improved to upgrade test capabilities, and the MPS PLC modules required to complete the system were ordered.



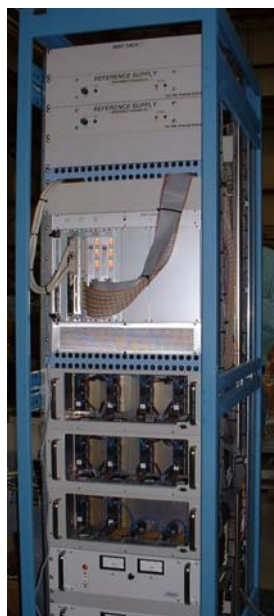
A preliminary list of MPS inputs in the Ring Service Building was issued for review. These inputs must be identified and understood before we can finish the design of communications cables in the Ring Service Building.

Work continued on implementing alarms in the conventional facilities system. A PLC design and installation instructions for the Chilled Water system were completed.

The design for the HEBT and RTBT magnet power supply hardware flow interlock was completed and approved, and the HEBT network "fix-it" package to pick up missing cables was also completed.

A web camera was installed to allow remote observation of the anticipated iceball formation on the return cryogenic return line during the upcoming cooldown.

At BNL the HEBT halo and momentum scraper rack, including the IOC, has been built and installed in the C-A department motion control test area. It is currently undergoing checkout and calibration, using EPICS screens, rather than the traditional C-A control system S/W. The H/W checkout includes digital I/O, analog input, and motor control. The ring collimator rack is being built and will be moved to this area soon for similar treatment. The rack is shown in the pictures below.



On the left is the front view, showing the IOC (and all I/O cabling), motor drivers (in pull-out drawers), and the power supplies for the motors and linear pots (position sensors). The I/O cabling supports analog input, digital I/O and the motor controller interface with light emitting diodes (LEDs) showing the state of limit switches, direction of travel, etc. The photo on the right shows the back of the rack, where the I/O cabling is broken out before being routed to tunnel-mounted junction boxes.

At this point, the basic functionality of the controls has been fully checked out. The main focus now is handling EMI. EPICS tools, such as StripTool are being used to characterize the noise and to assess various abatement techniques, such as re-routing intra-rack cabling. Calibration and possibly digital filtering within EPICS will follow. This has been the first use of EPICS by the BNL mechanical and electrical technicians and overall it has been positive experience once they had become familiar with the idiosyncrasies of EDM.

Work continued in the laboratory on the LEBT chopper prototype. Some features have been added at user suggestion, and the controller's setup/status interface architecture is being improved. A trial conversion of three ORCAD designs to DxDesigner was successful as part of an evaluation of this product. The design of the new timing system board for diagnostics network attached devices (NADS) was reviewed.

Installation

Craft Snapshot 12/7/04

ASD productive craft workers	64.0
Foremen (Pd by 15% OH)	6.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	73.0
Less WBS 1.9, 1.2 etc	17.0
Less absent	1.0
TOTAL PD BY ASD/ORNL DB WPs	46.0

Accelerator Physics

The HEBT elevation will be 0.7 mm higher than the SCL elevation due to the present CCL elevation. Model calculations show that this elevation mismatch can be easily accommodated using the first two vertical dipole correction magnets in the HEBT.

A draft version of the facility-wide magnet polarity and wiring list has been circulated for review.

HEBT magnet testing is now underway. Each magnet will be tested at currents consistent with 1.3 GeV operations.

Operations

Continued the Operability Run

Participated in the PPS Review

Modified the PPS Partial Certification Process

Ran a complete Recertification Process on the PPS for the Warm Linac and Cold Linac

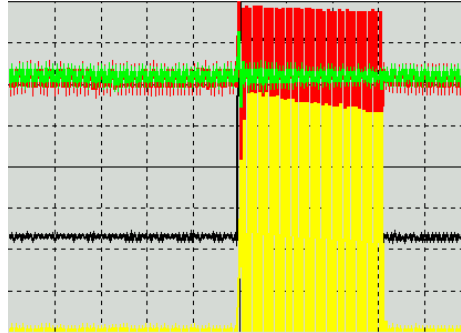
Submitted 530 ASD Assets into the DataStream system, the DTL-CCL Diagnostics and RF Systems

Worked on the Transition to Operations

Ion Source

During the 3-day maintenance period the fully reconditioned ion source #4 has been installed on the frontend, leak checked, and conditioned. This change became necessary after a discharge between the e-dump and the ion source body limited the H⁻ output to ~20 mA.

Working with Yoon Kang and his network analyzer we have further reduced the inductance in the antenna matching network. The new configuration should generate 43% smaller voltages in the antenna loop, which reduces the E-field based RF noise emission, and increases reliability. For 30 kW of 2 MHz, the new match gives 560 A pk-pk antenna current (yellow trace) with a very nice ratio of forward (red trace) and reflected power (green trace) during the 1 ms long pulses.



We have switched off the extractor high voltage supply and applied an appropriate caution tag. This step was taken after we found signs of galvanic activity and a possible leak on a ceramic break of the water cooling loop inside the LEBT chamber.

Numerous verifications have shown that the extractor voltage does not benefit the beam current output because the beam production is limited by the negative ion density in the meniscus and not by the extraction field. In addition, with our LEBT configuration a positive extractor voltage will not reduce the damage expected from back-streaming, positive ions. This measure should eliminate future water leaks that caused 1.1% ion source unavailability on September 20, 2004.

In the future it is likely that we will need the technical capability of water-cooling high voltage electrodes inside the vacuum. Therefore, we will start to operate the Ion Source Hot Spare Stand extractor with high voltage until we better understand the problem and have found and tested a sound solution.

During the 3 day maintenance period we installed a second ion gauge on the LEBT chamber. Initially it will allow us to keep running even when both filaments burn out on one of the gauges. When fully integrated we can avoid ion source shutdowns when one of the gauges gives bad reading for a short period of time. This has happen on September 19, 2004, and caused 0.05% ion source unavailability.

Survey and Alignment

This week S&A mapped the Ion Source, RFQ, MEBT fiducials along with MEBT Quad edges.

A number of the fiducials have been detached from the Ion Source/LEBT. Only four remain on the flange faces, none have been replaced at this time.

Measuring components on the MEBT has become extremely challenging due to line of site obstructions. Raft 3 is by far the least accessible. Rust on the quads remains an issue to providing high accuracy data (along with wiring).

BPM Z position observations were made on the first three devices. It is possible that better measurements can be made using optical methods on BPM1, 2 and 4. The line of sight to BPM3 is obscured.

Data has been compiled and sent to interested parties.

S&A final aligned a warm section in slot # 6. This completes four aligned warm sections.

We final aligned the two quadrupole magnets and beam pipe on a warm section raft at the end of the LINAC. We are awaiting the raft's placement in the tunnel where it will be final aligned to ideal position.

S&A rough aligned the quadrupole magnets on two warm section rafts in the Magnet Measurement area of the CLO. These two warm section rafts are awaiting beam pipe installation.

Two additional 8Q35s magnets were also fiducialized.

Our monthly measurement campaign of the RTBT and Compressor building is underway. S&A is also in the

S&A attended to an emergency situation which occurred on Friday the 3rd. While lowering the shutter block into instrument line # 3 shutter block housing by the GC, the shutter became wedged against the core vessel insert. Concerns were raised about this wedging of the shutter and the impact on placement of the core vessel insert. Several checks were performed on our part with results showing no change from time of installation. During our checks, another issue arose. Upon our inspection of the alignment tray, it became apparent that the downstream support was damaged. We do not know when it was damaged as we are not the keeper of the alignment tray. This results in us having to re-verify the set up in the alignment hut. If the alignment tray was damaged before our set up was established in the alignment hut, then we must re-establish our reference line and realign shutter #3.

Mechanical

Three days of the past week were dedicated to maintenance of the Front End and Warm Linac.

We were able to replace the RF window on DTL5. The former window seemed to be having vacuum excursions and causing us to run the cavity at a very low duty factor.

A troublesome flow meter was replaced on the MEBT

The RFQ chillers were drained, flushed, and refilled with clean water

Due to suspicious vacuum readings, additional leak checking was performed on DTL2

Water Systems Installation

- Installation of the HEBT tunnel magnet cooling system continued.
- Installation of the RING SB power supply cooling system continued.
- Installation of the RING SB power supply cooling system pump upgrade continued.
- Installation of the RING SB power supply cooling system make-up water supply was started.
- Advance procurements on RTBT water systems were started.
- Maintenance on the Linac water systems consisted of change out of resin bottles, cleaning of filters, and change out of FES Chiller water volumes.

Ring Systems Installation

- The HEBT Linac Dump Shielding Assy installation was completed.
- The Ring Injection straight section downstream Long Kicker Magnet was received.
- The Ring Injection Long Kicker Magnet is undergoing vacuum leak testing.
- The Ring Injection straight section upstream Long & Short and downstream Long Kicker Magnets were installed.
- The Ring arc heavy cable installation continued.

- The RTBT crane rail support cracks were repaired

Magnet Task

We now have four warm sections in place. Two of these have had vacuum connections completed to the cryomodules. A fifth warm section is ready to be set in place. A sixth warm section is ready for alignment and another is being assembled. We also continue to map 8Q35's.

We are also preparing the 21Q40 measurement system which involves a new power supply.

Electrical Group

Installation of SCL-ME5 continued and is awaiting connection of water systems for completion. Checkout of SCL-ME4 was completed this week. HVCM personnel supported SCL-ME3 HPRF klystron testing and PPS certification this week. LEPT chopper pulsers were upgraded with grading resistors and improved charging resistors, and should be back in service next week. Design work continues on an improved IGBT gate driver, with parts ordered for prototyping.

HPRF

Supported PPS checkout for RF Systems RFQ through SCRF-ME2.

SCRF-ME3: High power X-ray and RF Survey results good. High power testing nearly complete with on-site help from William Roybal (LANL).

SCRF-ME4: First two (of four) klystron HV tank preparation was completed and waveguide connections started with on-site help from David DeBaca (LANL).

The PLC code for the NC transmitters was modified to use the EPICS recommended sampling time as the transmitter sampling time. Pam Gurd developed the EPICS code and consultant John Reed the PLC code. The code is being tested on the CCL4 transmitter.

Ring RF:

- AC power installation is underway.
- We have received the remaining hardware for the third station.
- Disassembly of the 4th station at BNL began Monday with shipping and arrival at SNS expected before the end of 2004.

LLRF

Installation: Installation continues on SCL ME-4 and ME-5. We are awaiting 110V AC power in the downstream racks for ME-4. This may impact our ability to support high-beta cryomodule testing per Campisi's schedule. The fiber optic arc-detection cables in the tunnel were rerouted for a cleaner installation and connected to the RF power couplers on the medium-beta cryomodules 3-8. Checkout of the arc-detection test system for MB 3-8 is in progress and will be completed next week.

Upgrades: We plan to upgrade to the next version of FPGA code for the FCM and HPM next week. This provides for independent RF Gate control on all stations, whether single or dual (as in the MEBT and SCL). It will also clear up some confusing indications of the source of MPS faults. (At present, if one HPM in a dual system pulls the MPS, it appears that both HPMs pulled the MPS)

FPGA Code Development: Kay Kasemir worked with Larry Doolittle at LBL this week on the implementation of Larry's latest FPGA code for the FCM. This code offers improvements over that presently in use, and we look forward to testing it further during Larry's upcoming visit to ORNL, either the week of Dec 13 or Dec 20.

Reference System: There was significant progress in the reference system installation due to the efforts of one of our visiting LANL technicians, Roy Przeklasa.

Cryo Group

Beam Diagnostics

Data was taken and a short report written on the BCM calibration board delivered by BNL. Software was developed to log and view data and calculate statistics.

A Wire scanner script was developed to copy new data files to server.

Work on a Channel 0 NAD and viewer began. This facility will provide general announcement information that complements the detailed data displayed by Channel 13.

PC setup continued in SCL and HEBT.

Final layout was completed and a quote for production of the timing card was received. The layout is being reviewed for us courtesy of Jeff Patterson in the Controls group.

More system information was entered into the database and some QA was performed.

An introductory talk on the database tools was prepared and presented at the Friday Group Meeting. A similar presentation will be made at the Controls group meeting next week.

Several staff members will visit BNL next week.